

5.0 RECOMMENDED PLAN & PROJECT FEATURES

The recommended plan (refer to figure 11), will consist of rock mining within the allowable areas identified in the Issue Advisory Teams report (refer to figure 10). The caveats on timing of mining in specific areas is considered to be part of the recommended plan. The recommended plan also includes a mitigation funding fee, based on a fee per ton on all limestone sold from the Lakebelt Area. Proceeds from the mitigation fee will be used to perform mitigation activities appropriate to offset the environmental impacts due to mining including acquiring environmentally sensitive lands and restoring, managing, and maintaining their natural functions. The first priority for wetland mitigation will be the acquisition and restoration of the Pennsuco wetlands as partial mitigation for wetland impacts resulting from the mining. Analysis of the hydrologic impacts resulting from future mining was added as a requirement of the Phase II Plan. Mitigation measures, if needed, will be recommended at that time for inclusion in the Lakebelt Mitigation Plan. The recommended plan may be modified after completion of the Miami-Dade County wellfield protection program. This program is investigating the adequacy of its existing protection plan from potential impacts from limestone mining. The Lakebelt Implementation Committee will specify in their Phase II master Plan the design criteria for lake littoral areas, and identification of special features, such as rookeries.

6.0 ENVIRONMENTAL EFFECTS

This section includes a brief summary of the expected beneficial and adverse physical, ecological, and socio-economic effects to resources of concern within the study area. It does not attempt to provide comprehensive coverage of all effects on all resources; rather its purpose is to provide a summary account of effects resulting from the recommended plan. In all instances the assessment of effects is based on a comparison between the recommended plan and the existing condition.

6.1 Hydrology

Management of the natural resources within the Lakebelt requires an accurate understanding of the hydrology within and surrounding the area. Miami-Dade County's largest potable water wellfield is located there along with the Pennsuco wetlands, a 12,000 acre sawgrass wetland that has been the subject of government acquisition and protection for several decades. The area is also adjacent to Water Conservation Area 3B and Everglades National Park, which could be adversely affected by improper resource management within the Lakebelt.

For these reasons, the hydrologic impacts of limestone mining and water management within the Lakebelt have been the subject of investigations by both the South Florida Water Management District and the mining industry. An Issue Advisory

Team was appointed by the South Florida Ecosystem Restoration Working Group specifically to review the issues, and potential impacts, of hydrologic changes within the Lakebelt induced by additional limestone mining. Computer simulations of the hydrology by the South Florida Water Management District (Wilsnack, 1997) and the industry (MacVicar, 1997 and MacVicar 1998) were evaluated by the Team. An additional evaluation by the South Florida Water Management District (Wilsnack, 1998) was also available for the preparation of this report.

The general conclusions presented below are based on the preliminary regional modeling contained in **Appendix A**. Detailed modeling with rigorous statistical analysis will be conducted during development of the Phase II master Plan.

Several general conclusions were evident as a result of the team's evaluation:

- 1) Seepage rates from WCA3B to the east increased with large-scale excavation of new areas in the Lakebelt. As the acreage of mining increased, it became apparent that the location of the new quarries was more important than the size in determining the impact on seepage from WCA-3B. Quarries located adjacent to the L-30 canal showed a greater impact on seepage from WCA-3B. The footprint for mining that was recommended by the Issue Advisory Team included a buffer between new mining and the L-30 canal.
- 2) Seepage rates from Everglades National Park to the east showed some relationship with larger quarries in the southern Lakebelt area near the L-31N canal. Since operations of the L-31N canal have the dominant impact on seepage from Everglades National Park, additional mining east of the canal had a small, but measurable, effect.
- 3) Water levels in the Pennsuco wetlands could be affected by new mining adjacent to the Dade-Broward levee. However, it was also noticed the Northwest Wellfield Supply canal has a significant impact on the Pennsuco wetlands and changes to the design of this canal may be able to affect any impacts of additional mining.
- 4) There was no risk of seepage related impacts in the near term since the hydroperiod impacts are only seen with mined acreages much larger than any that will be seen in the near future.
- 5) Although it was concluded that there are potentially significant impacts to large-scale increases in mining, it also seems true that there are readily available strategies to mitigate for these impacts. It is also clear that time is available to complete a more definitive analysis and prepare the appropriate solutions. This has the further advantage of allowing the Lakebelt Plan to reflect the ideas for the area that are being considered within the Central & Southern Florida Project Comprehensive Review Study.

6.2 Water Quality

The excavation of mineral deposits pursuant to Lakebelt construction would convert a large portion of the Biscayne Aquifer to surface waters. The introduction of surface runoff, contaminants released at point sources (such as accidental spills), and eutrophication could result in significant changes to water quality in the Lakebelt area. Urban runoff could affect aquatic life that may be present and threaten the quality of the raw drinking water source for the Miami area supplied by the Northwest and West Wellfields.

6.2.1 Aquatic Life Resources

Monitoring in the Lakebelt area found existing water quality in the borrow pits to be in compliance with ambient water quality standards (refer to **Appendix B**). Hence, existing aquatic life will not be adversely impacted. In addition, analysis of the monitoring program did not identify any factors, such as borrow pit morphology, mining, or reclamation practices, which would cause an adverse water quality impact in the proposed Lakebelt. This is providing that no alterations to source water occur. However, changes in source water to the borrow pits could produce water in the Lakebelt that exceeds ambient water quality standards for several parameters. Current water quality in borrow pits in the Lakebelt area is linked to a groundwater geochemical and borrow pit limnological processes. This produces water chemistry that leads to calcite precipitation within the borrow pits. As noted previously, water quality could be degraded by additional input of pollutants from point and nonpoint source runoff. The impact of these two factors on water quality in the proposed Lakebelt is discussed below.

6.2.1.1 Changes in Groundwater Inputs

The water quality inventory identified a limnological process dependent on the high alkalinity and calcium content of the Biscayne Aquifer. This is important in maintaining borrow pit water quality and future water quality of the proposed Lakebelt. As discussed, the high alkalinity and calcium concentrations result in precipitation of calcite in the borrow pit. Calcite precipitation and accumulation in bottom sediments has also been documented in naturally occurring "marl" lakes; i.e., those receiving groundwater inputs from calcareous aquifers (Brown, et al. 1992 and Duston et al. 1978). The calcite precipitate would form suspended solids, which would scavenge trace metals, nutrients, organic carbon, and other suspended solids (e.g., phytoplankton) upon settling from the water column to the bottom sediments.

The beneficial effects of the calcite precipitation process in maintaining water quality are provided in a study by Burney and Forman (1991). The investigators evaluated water quality in a rock pit that received effluent from a wastewater treatment plant for 20 years. When this type of effluent is discharged to surface waters, it can decrease dissolved oxygen and enhance eutrophic conditions; however, the

investigators found the effluent to have no impact on the rock pit water quality. The investigators attributed the water quality maintenance in the rock pit to the continual removal of nutrients, organics, and trace metals from the water column by calcite precipitation. The effect of nutrient removal, particularly phosphorous in the form of calcium phosphate minerals (e.g., apatite), was also observed in marl lakes that were artificially supplemented with excess fertilizer (Hooper and Ball 1964). The fertilizer applications were found to be ineffective at increasing lake productivity, which Hooper and Ball attributed to phosphorous precipitation to the bottom sediments. The absence of measurable phosphorous in the borrow pits in comparison to groundwater and canal water samples may also provide evidence that calcite precipitation removes phosphorous. The result of this is the low productivity of the borrow pits, as indicated by the low chlorophyll a.

The Lakebelt water quality inventory results indicated a gradient effect, with the eastern borrow pits containing lower alkalinity and calcium than the adjacent western borrow pits. Since groundwater flow is likely to be from west to east in the area, the results may reflect water movement from the westerly borrow pit, in which calcite precipitation has occurred, to the easterly borrow pit, resulting in the lower alkalinity and calcium concentrations. This may result in lower calcite precipitation and lower water quality remediation potential in the easterly borrow pits. In a large open water system, as in the proposed Lakebelt, groundwater will continue to supply water to the western edge of the proposed Lakebelt. However, due to distances across the Lakebelt and barriers left in place from historic mining, mixing of waters may be limited and lower alkalinities and calcium concentrations, well below saturation, in eastern portions of the Lakebelt may occur. Maintenance of a west to east groundwater flow gradient through the remaining Biscayne Aquifer and adequate mixing within the proposed Lakebelt will be essential for maintaining the calcite precipitation process. This process is required for long-term compliance with ambient water quality standards of the proposed Lakebelt.

6.2.1.2 Pollutant Inputs

Literature indicates that the water quality of borrow pits can be degraded as a result of surrounding land use; for instance, the input of excessive nutrients. Jackson and Maurrasse (1976a and 1976b) found that both rock-mined pits and real estate lake water exhibited cultural eutrophication because of excessive nutrient inputs from residential nonpoint runoff and point source discharges. This cultural eutrophication resulted in excessive algal growth, forming aesthetically displeasing algal mats and odors. Adverse water quality impacts included depletion of oxygen, even at shallow depths, together with elevation of ammonia and sulfides. In a more recent study, Hudy and Gregory (1984) found that borrow pits located in urban areas may be impacted by eutrophication, which could deplete dissolved oxygen in the hypolimnion of the lakes.

Weinberg et al. (1980) provides supporting evidence of lake contamination from urbanization. The investigator reported elevated levels of several contaminants,

including chloride, total kjeldahl nitrogen, and chemical oxygen demand, in a lake receiving runoff from a high-density residential area. Beaven and McPherson (1978) examined borrow pits in the vicinity of a highway. They found elevated levels of chromium in water samples and lead in sediments relative to borrow pits in mostly undisturbed areas. Contamination of borrow pits from urban runoff is possible. Studies by Miller et al. (1979) and Matraw and Miller (1981) indicate that runoff from a variety of land uses in South Florida, including residential, commercial, and highways, contains elevated nutrients, trace metals, chemical oxygen demand, dissolved solids, and indicator bacteria.

Stability of water quality in the borrow pits is a function of the limited amount of development in the Lakebelt area. Agricultural activities adjacent to borrow pits were not found to alter borrow pit water quality. This is probably a result of embankments left during excavation; hence there is limited direct runoff to the borrow pits. Urbanization may remove these barriers and cause surface runoff to be directed into the borrow pits, thereby eliminating the remediation provided by groundwater infiltration. This would suggest that land use planning adjacent to the Lakebelt, coupled with runoff control measures, will be necessary to prevent excessive nutrients/contaminants from entering the proposed Lakebelt.

6.2.2 Drinking Water Supply

The borrow pit monitoring in the Lakebelt area also found existing water quality to be in compliance with drinking water standards (refer to **Appendix B**). This indicates that water quality in borrow pits in the Lakebelt area is adequate as a public water supply. In fact, a number of parameters were lower in the borrow pits than surrounding groundwater (e.g., iron, manganese, and TOC). This suggests that an increase of open water may be beneficial to the water supply. Lowering iron and manganese will improve the aesthetic quality (taste and odor) of the water and reduce the amount of chemical treatment required and sludges produced. TOC reduction will reduce the amount of chlorinated hydrocarbons, a byproduct of chlorination. This may reduce the health risk of the water supply to the public.

Analysis of the monitoring program results did not identify any factors, such as borrow pit morphology, mining/reclamation practices, or proximity to canals that would cause an exceedance of drinking water standards. However, if alterations to source water occurs, such as input of point source discharges and non-point source runoff (via canals), exceedance of drinking water standards for several parameters may result.

Current water quality in borrow pits in the Lakebelt area is linked to limnological processes in the borrow pits and geochemical processes in the source groundwater. Future water quality is likely to continue to be greatly influenced by these same processes as well as changes in the surrounding area that result in additional input of pollutants from point and non-point source runoff. The impacts of these two factors on water quality in the proposed Lakebelt were previously discussed.

In addition to factors affecting chemical contamination, concerns regarding waterborne disease in the Lakebelt must also be considered and evaluated. This is especially true with respect to the potential impact(s) on the Northwest and West Wellfield public water supplies. Waterborne disease is a general term that encompasses gastroenteritis, shigellosis, cholera, and dysentery. These gastrointestinal maladies are caused by a variety of microorganisms present in human as well as other warm-blooded animal fecal matter. In North America, outbreaks of waterborne disease are uncommon due to treatment and disinfection of our wastewater and chlorination of our drinking water supplies. Nonetheless, recent outbreaks of waterborne disease in the United States have occurred; microorganisms resistant to disinfection processes caused them. Protection of drinking water supplies from these microorganisms is accomplished by routine filtration. All surface water authorities in the United States are required to provide filtration. However, since Northwest and West Wellfields are groundwater supplies, they are excluded from this requirement.

Increasing surface water areas adjacent to the Northwest and West Wellfields by limestone excavation may affect the residence time of water in the wellfields. This in turn could potentially reduce the natural filtration properties provided by the groundwater systems. It must be noted that the high permeability characteristics (i.e., solution cavities, channels, and conduits in the limestone) of the Biscayne Aquifer, the extensive historic mining in the vicinity of the wellfields, and the close proximity of canals to the wellfields make it probable that the effectiveness of the natural filtration processes is already somewhat compromised. Therefore, it is critical to determine the extent to which mining in the vicinity of the wellfields will further compromise the natural filtration processes that currently exists at the Northwest and West Wellfields.

Currently, disease-related microbial contamination in the Lakebelt is minimal. This is due to the absence of significant human activity within and adjacent to existing borrow pits and the absence of wastewater treatment plant effluent discharges to any borrow pits or adjacent canals. In addition, the unique properties of the water chemistry (i.e., calcite precipitation) in the borrow pits likely provide for the transformation of suspended microorganisms to bottom sediments, where their viability is naturally eliminated. It is expected that the proposed Lakebelt will be minimally impacted by human-related contamination as long as land use remains unchanged in areas surrounding the Lakebelt, and the Lakebelt does not receive any point source wastewater effluent or non-point source urban runoff, via canals, which can contain exceedingly high levels of microorganisms (Matraw and Miller 1981). Additionally, high-impact recreational activities, such as public bathing and pleasure boating, also have the potential to be a significant source of microbial contamination.

6.2.3 Recommended Mitigation Measures

No existing water quality related impacts of mining in the Lakebelt area were identified by the Lakebelt inventory. However, the following potential consequences of the proposed Lakebelt plan were identified:

- Poor west to east mixing will lower alkalinity and calcium concentrations in eastern areas of the Lakebelt as a result of calcite precipitation.
- Changes from existing agricultural and wetland land uses to more urbanized land use in the vicinity of the Lakebelt may add pollutant inputs.
- Input of waters, such as treated and untreated wastewater and/or stormwater runoff via canals to the Lakebelt, may reduce water quality.
- High-impact recreational activities may result in greater potential for microbial contamination of the Lakebelt waters.

The two noted public water supply wellfields provide the Metro-Miami-Dade populace with the majority of its public drinking water. Thus, protecting water quality in the Lakebelt area is imperative. Mitigation measures to provide the level of protection necessary for the long-term use protection of the wellfields can be separated into two categories. First, are measures associated with the mining and reclamation practices, which will enhance mixing within the Lakebelt, minimizing unwanted water inputs into the Lakebelt. The recommendations include:

- Removal of existing barriers between borrow pits by dredging to a minimum of 15 feet of water depth.
- Removal of any existing direct canal connections to borrow pits, and maintenance of a minimum 100-foot distance between canals and the Lakebelt.
- Construction of a berm around the Lakebelt to prevent direct entry of surface water runoff.

Secondly, measures related to land use can be cumulatively combined under the heading of a Lakebelt Management Plan. The plan should include measures to protect the Lakebelt from activities that may jeopardize future water quality through chemical and microbial contamination. Measures could include:

- A watershed protection plan to protect/prevent future development of the western wetland conservation areas from any future land development of all lands zoned for mining and mitigation as described in the Lakebelt Master Plan. This would include prohibiting limestone excavation in an effort to maintain input of the highly alkaline groundwater to the Lakebelt.

- Land use criteria should be developed to prevent future urban runoff from negatively impacting water quality in the Northwest Wellfield Protection Area.
- A recreation plan that would focus on activities that would lessen excessive chemical and microbial contamination of the Lakebelt.

6.3 Vegetation

Implementation of the Recommended Plan (Figure 11) would convert approximately 15,845 acres of wetlands to deep quarry lakes, for a total of approximately 20,796 acres of quarry lakes within the Lakebelt area. The majority of this impact would occur to melaleuca infested wetlands, which would have a positive benefit of removing a potential seed source of this highly invasive exotic species. For a detailed breakdown of this alternative by cover type refer to table 6.6-1.

6.4 Wildlife

The Everglades Research Group reported in their 1995 wildlife report (**Appendix D**) that the invasion of melaleuca into Everglade's marsh and its subsequent development into dense closed canopy forest, caused a shift from wetland to non-wetland species. The pattern of the shift was the same regardless of whether the number of species or individuals was considered. As succession moved from marsh towards 75% melaleuca the numbers of non-wetland species increased without a decrease in numbers of wetland species. Once melaleuca density went above 75%, wetland associated taxa decreased in both numbers and abundance.

Implementation of the recommended plan would result in the conversion of approximately 1,000 acres of marsh and approximately 11,000 acres of marsh with varying degrees of melaleuca infestation to open water lakes with some associated emergent littoral wetlands. This conversion would lead to a change in the species associated with these cover types. The open water lakes and associated emergent littoral wetlands would be expected to support a self-sustaining fishery along with the wildlife species that are able to exploit this aquatic habitat. The habitat evaluation (Section 6.6) attempts to capture functions and values lost through mining and the resulting change in wildlife functions and values as the lakes with their associated littoral zones are constructed and evolve into self-sustaining communities.

6.5 Endangered Species

In a May 19, 1998 letter (FWS Log number 4-1-98-I-402), the USFWS concurred with the USACOE's determination of no effect to any Federally listed

species would result from implementation of the proposed Lakebelt plan. The letter also contained the following conservation measures: 1) Maximize short hydroperiod wetlands as wood stork foraging habitat, 2) Design the mined areas to include vegetated islands for nesting/roosting sites for listed species and other migratory birds, 3) Provide vegetated wildlife corridors between mined areas for listed species and other terrestrial mammals, 4) Control public access to keep human disturbance to a minimum, and 5) Maintain adequate water supply and water quality. These conservation measures will be used in the development of the Phase II Master Plan being developed by the Lakebelt Implementation Committee.

6.6 Habitat Evaluation

Utilizing the habitat evaluation framework established in section 3.12, the Miners' Recommended Plan would result in impacts within the study area to the existing wetland's functions and values as expressed as habitat units. The results of the evaluation are presented in table 6.6-1.

Table 6.6-1 Summary Of HU's Resulting From Miners' Recommended Plan

COVER TYPE	ACRES	CHANGE IN ACRES	HU's	CHANGE IN HU's
Agriculture	2,009.04	(1,327.52)	341.54	(225.68)
Dense Melaleuca	6,931.48	(4,991.62)	2,911.22	(2,096.48)
Dense Melaleuca Saplings	3,223.37	(3,419.46)	1,418.28	(1,504.56)
Developed Lands	1694.62	(76.56)	101.68	(4.59)
Disturbed (Forested & Open)	1,863.37	(763.65)	931.69	(381.83)
Disturbed Prairie	19.10		13.08	
Disturbed Prairie w/ Melaleuca (10-50%)	145.27	(269.12)	97.33	(180.31)
Disturbed Prairie w/ Melaleuca (50-75%)	70.59	(146.22)	43.41	(89.93)
FPL Transmission Corridors	700.37	(18.50)	448.24	(11.84)
Lake Perimeter	694.59	(972.32)	24.31	(34.03)
Other Water	334.52	(208.14)	102.03	(63.48)
Prairie	11,654.32	(944.37)	11,421.23	(925.48)
Prairie w/ Melaleuca (10-50%)	3,655.81	(1,409.45)	3,290.23	(1,268.51)
Prairie w/ Melaleuca (50-75%)	3,011.00	(1,209.22)	2,167.92	(870.64)
Tree Islands	257.08	(88.99)	233.94	(80.98)
Willow Heads	25.78		24.49	
Pond Apple	14.82		13.63	
SUBTOTAL	36,305.13	(15,845.14)	23,584.26	(7,738.34)
Canals	413.29	(25.67)	152.92	(9.50)
Lakes (Open Water)	20,796.76	15,870.54	4,367.32	3,332.81
Littoral Zone				
SUBTOTAL	21,210.05	15,844.87	4,520.24	3,323.32
TOTAL	57,515.18		28,104.49	(4,415.02)

*Note: Lakes only have value if they have associated littoral zones.

The miners recommended plan would result in a net loss of approximately 7,738 habitat units. If littoral zones were constructed adjacent to the lakes, the lakes would result in a 3,332 habitat unit increase in the functions and values of the lakes. This would lower the net loss to approximately 4,415 habitat units. The functions and values resulting from the constructed littoral zones would lower the overall functions and values net loss still further. The design and subsequent evaluation of the littoral zones and lake habitats will be conducted during the development of the Phase II Master Plan.

6.7 Land Use

The recommended plan is consistent with current land uses. The Lakebelt Implementation Committee is currently developing a detailed master plan for the Lakebelt area. The following are the major components of the detailed master plan:

- Land use plan that considers habitat areas, recreation areas, and other land uses.
- Mitigation program that considers regional ecosystem considerations, habitat objectives, management plan for the Pennsuko and other wetlands, design criteria for lake littoral areas, and identification of special features, such as bird rookeries.
- Water management considerations including regional seepage management, water storage, flood protection, and identification of new or modified facilities.
- Land ownership and management program that considers institutional and financial requirements and land swaps.
- Private property rights.
- Lake design including recreational access and use, ecological productivity, wellfield protection, and regional water management considerations.
- Wellfield protection program that considers access restrictions, perimeter security, and use restrictions.
- Recreational use plan that addresses types of recreation, ownership, access and security.

- Phasing plan that considers blasting restrictions, conflicts with other existing land uses, potential transition areas, access management and land swaps.

6.8 Hazardous and Toxic Wastes

Implementation of the recommended plan would not be expected to result in the any new sources of hazardous or toxic wastes.

6.9 Cultural Resources

In a letter dated December 4, 1992, the Florida State Historic Preservation Officer offered the opinion that historic properties listed or eligible for listing on the National Register of Historic Places may be affected by the proposed project. The Florida State Historic Preservation Officer recommended that, prior to initiation of ground disturbing activities, systematic archeological surveys should be performed. Such surveys will be completed and the results reviewed prior to issuance of permits under this programmatic document. The purpose of the surveys will be to locate and assess the significance of historic properties and determine if activities proposed under the permit will adversely affect these properties. If it is determined that significant historic properties will be adversely affected by the project, a plan will be developed, in consultation with the Florida State Historic Preservation Officer, to avoid, minimize or mitigate effects to historic properties. Actions under the plan shall be completed prior to initiation of ground disturbing activities. All work will be conducted in compliance with the National Historic Preservation Act of 1966, as amended (PL 89-655) and the Archeological and Historic Preservation Act, as amended (PL 93-291). Based on the fulfillment of these conditions, the Florida State Historic Preservation Officer has concurred that work under this PEIS will have no adverse affect on properties listed or eligible for listing on the National Register.

6.10 Air Quality

Air quality could be impacted as a result of the build-out of the Lakebelt plan in the following ways: 1) suspended particulate matter generated from mining activities; 2) emissions from mining machinery; and 3) emissions from diesel driven project pumps.

Mining activities conducted under the Lakebelt plan are not expected to cause significant impacts to air quality of the region. The primary source of air emissions would be diesel drive project pumps and vehicular traffic and equipment associated with mining. Equipment would be maintained at manufacture's specifications to reduce air emissions. The air emissions estimated to result from the Lakebelt plan could not be accurately quantified

based upon information available regarding design and operation of the project. However, air emissions are not expected to increase over current levels.

Particulate and fugitive dust generated during mining and transportation activities will need to be mitigated in the vicinity of the South Florida Test Service facilities at 17301 Okeechobee Road. Fugitive dust and the resulting reduction in the quantity and quality of solar radiation (ultraviolet portion of sunlight) would adversely impact their testing facility. As mining operations move closer to the facility dust suppression on adjacent haul roads will need to be accomplished. Natural air dispersion of the pollutants generated, air circulation patterns characteristic of the area, and the low frequency of air stagnation or inversions in the project area minimizes the potential for developing concentrations in excess of any applicable standards.

6.11 Aesthetic Resources

The main visual component of the proposed Lakebelt plan is the lakes that will be created in what is currently predominately melaleuca forests. The Lakebelt plan does not include any tall structures that would interrupt the existing landscape profile. As a detailed mitigation plan is developed for the littoral zone of the lakes and the adjacent areas on the upland side of the littoral zone a natural appearing setting will be achieved. The human perspective will be of a lake that transitions into forest or marsh.

6.12 Noise

Noise impacts associated with implementation of the Lakebelt plan would not increase over what is currently associated with the project area. In the later years of plan build-out, mining activities will slowly cease and the only noise will be associated with the urban areas and transportation corridors in proximity of the project area.

6.13 Recreation

The recommended plan will not significantly impact existing recreational facilities. The Lakebelt Implementation Committee is currently developing a detailed master plan for the Lakebelt area that will address future recreational development.

6.14 Socio-Economics

The recommended plan will not significantly impact existing socio-economic conditions in Florida. The continuation of a reliable source of rock will allow the continued growth and prosperity that peninsular Florida has

experienced during the last thirty years. All of this growth requires rock in order to be accommodated.

6.15 Northwest Wellfield

The proposed Lakebelt mining plan would allow rockmining in close proximity to the Northwest Wellfield, which may compromise the existing wellfield protection program. The Lakebelt Committee established a wellfield protection subcommittee to review the adequacy of the existing wellfield protection program and determine what changes, if any are needed to ensure the protection of the watershed and urban water supplies as the Lakebelt plan is developed. Measures to prevent the reclassification of the Northwest Wellfield as groundwater under the direct influence of surface water and thus requiring more treatment will be an important component of this effort.

The wellfield protection subcommittee has identified the tasks that must be completed to properly analyze the County's wellfield protection program. Miami-Dade County, South Florida Water Management District and the rockmining industry are providing the funding for this two-year effort. The data obtained from this effort will be used to identify potential impacts from continued mining in the vicinity of the wellfield and to develop a comprehensive wellfield protection plan for the Lakebelt area. If impacts are identified, such as increased risk to the potable water supply or reclassification of the water supply source to "groundwater under the direct influence of surface water," activities required to mitigate those impacts will be identified.

6.16 Secondary and Cumulative Effects

Cumulative impacts are impacts likely to occur due to the proposed action or alternatives in combination with other past, present and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. For example, cutting one acre of a 5,000-acre forest to create a homesite may be an insignificant impact. If the remaining forest has been divided into similar one-acre homesites, similar development of the sites would be reasonably foreseeable, and the cumulative impact of clearing all lots would be significant. Four factors are considered in the assessment of cumulative impacts:

- 1) impacts which would occur as a result of the proposed action;
- 2) geographic boundaries of the impact;
- 3) impacts that have occurred as a result of past actions; and
- 4) potential impacts of reasonably foreseeable future actions.

Impacts which would occur as a result of the Proposed Action

The analysis conducted for the DPEIS has resulted in a determination that significant negative impacts would occur to the environment as a result of the proposed action. Build-out of the proposed Lakebelt plan is expected to cause negative impacts to native vegetation, wildlife, land use, and regional water supply. The proposed plan could have positive impacts on recreation resources within the project area. With a properly designed mitigation plan incorporated into the Lakebelt plan the project would result in significant long-term positive impacts to the Everglades ecosystem by restoring the wetland functions and values of the Pennsuco wetlands and other, as to be identified degraded wetlands in south Florida.

Geographic Boundaries of the Impacts

In order to evaluate the cumulative impacts of an action, geographic boundaries must be established. Physical boundaries such as watersheds, biological boundaries such as habitats, socioeconomic boundaries such as market areas or regions, and political boundaries such as counties may be appropriate for setting analytical parameters depending on the specific values affected. For each resource, an outer boundary can be determined beyond which the impacts of the proposed action are not extended. In considering the proposed action, the geographic boundary of the area of impact ranges from the boundaries of the project area as in the review of land cover impacts to the entire southern Everglades region as in the review of water quantity impacts due to increased seepage out of WCA-3B.

Impacts that have occurred as a result of Past Actions

Past actions within the established geographic boundaries for resource evaluation have resulted in impacts to the environment. It is not possible or necessary to quantify and qualify the conditions of the entire Everglades ecosystem prior to the first impacts of man and identify each subsequent action and its impacts. Water management and land development activities have significantly altered the region of the proposed action (the Everglades ecosystem) over the past 100 years. These activities have resulted in a well-documented general decline in water quality, wildlife resources, and ecological integrity.

Potential Impacts of Reasonably Foreseeable Future Actions

Impacts that may accumulate from other reasonably foreseeable actions in the geographic boundaries of consideration must also be considered in the evaluation of cumulative impacts.

Reasonably foreseeable actions related to the proposed Lakebelt plan would include the continued westward urban expansion of Miami.

Conclusion

In considering the four factors, build-out of the proposed Lakebelt plan would be expected to result in negative impacts, confined primarily to the immediate area. With the proper mitigation the proposed plan would not be expected to result in significant cumulative impacts to the Everglades ecosystem.

6.17 Relationship Between Local Short Term Uses of Man's Environment and the Maintenance and Enhancement of the Long Term Productivity

Implementation of the Lakebelt plan will allow the people of Florida the continued use of local inexpensive limestone rock resources. The mining of this resource is not without impacts to the environment, as discussed in the above sections. However, a well-designed mitigation plan will offset these short-term impacts. The mitigation plan will also contribute to the long-term restoration of the Everglades in the following ways: restoration of the Pennsuco wetlands through eradication of the melaleuca forests that have invaded this wetland; increase the spatial extent of high quality wetlands in the region; restore the habitat characteristics so that the wetlands support wetland dependent species. The Lakebelt area will also play an important role in water storage and management for restoration of the Everglades under the C&SF Comprehensive Everglades Restoration Plan.

6.18 Irreversible and Irretrievable Commitment of Resources

The term "irreversible commitment of resources" describes the loss of future options. This primarily applies to the effects of using non-renewable resources (e.g., minerals or cultural resources) or to processes or factors (e.g., soil productivity) that are renewable only over long periods of time. The term "irretrievable commitment of resources" refers to the loss of production, harvest, or use of natural resources.

The mining of approximately 21,000 acres of wetlands at total project buildout will have an irreversible significant impact on the environmental resources of the region. Once lost these environmental resources will be irretrievable. The limestone rock resources resulting from the mining will also be irretrievable as a natural product once used. The by-product of the limestone (e.g., concrete products) could be recycled as aggregate, which would reduce the demand on limestone. However, at this time due to the low cost of natural aggregate for concrete products and the high cost to recycle concrete products into aggregate there has not been an economic or societal will to pursue this option.

The mining of 21,000 acres at total project buildout is a spatial measurement, i.e., acres, is not an indicator of the functional wetlands values lost. Section 6.6 of the FPEIS presents a functional assessment analysis of the Miner's recommended plan and

Section 7.0, Mitigation Plan, discusses functional value replacement through restoration of degraded wetlands.

7.0 MITIGATION PLAN

The following discussion summarizes the mitigation elements of the recommended plan and how the plan was developed.

7.1 Mitigation of Wetland Impacts

A Memorandum of Agreement between the USACOE and the EPA outlines the federal policy on wetland mitigation and establishes a preference for the avoidance and minimization of wetland impacts over compensatory mitigation. However, despite this preference on the part of regulators, residual wetland impacts from economic development (i.e., where avoidance is not "practicable") are inevitable. In such cases, compensatory mitigation in the form of wetland creation, restoration, or enhancement will be used to offset the impacts of wetland loss on aquatic ecosystems, wildlife populations, and related social, economic, and aesthetic interests. The mitigation Memorandum of Agreement provides guidance on what constitutes appropriate compensation on the bases of wetland functions and values. The Memorandum of Agreement specifies that wetland mitigation should "strive to achieve a goal of no overall net loss of wetland values and functions". Moreover, the Memorandum of Agreement specifically requires that the assessment of what constitutes appropriate mitigation of wetland impacts should be based "solely on the values and functions of the aquatic resources impacted". In principle, therefore, compensation requirements under the federal program demand a comparison between the wetland functions and values expected from the mitigation project and those lost with the destruction of the original wetland.

The compensatory mitigation proposed for this project consists of the restoration or enhancement of degraded wetlands within the region and creation of littoral zones adjacent to the quarry lakes. The compensation ratio for such projects needs to be adjusted to account for the preexisting values and functions. Otherwise compensation projects would be "credited" for providing wetland values and functions that would have existed in their absence.

Another factor in determination of compensation ratios is the degree of risk and uncertainty in the mitigation projects to achieve anticipated wetland values and functions. The key to incorporating issues of risk into the determination of compensation ratios is estimating the magnitude of the risk of failure. In an attempt to manage ecological risks and maintain the long term value of the wetland compensation sites, a panel of professional biologist was asked to reach consensus as to the expected functional index values for the restored and created wetlands. The expected functional index (FI) values for the 20 covertypes found within the study area, as